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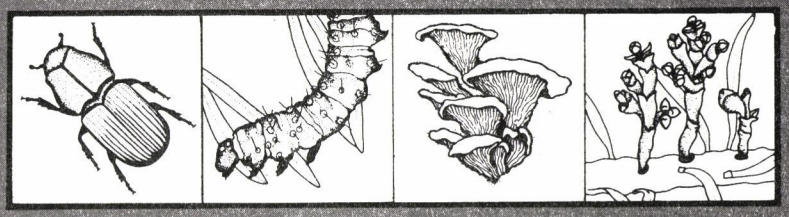

Report 85-8

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March 1985

DEMONSTRATION OF THE EFFECTIVNESS OF BASAL AREA CUTTING TO REDUCE TREE KILLING BY THE MOUNTAIN PINE BEETLE IN PONDEROSA PINE, CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS, MONTANA, 1984: ESTABLISHMENT REPORT

by

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ABSTRACT

During 1984, a demonstration project was established on the Crow and Northern Cheyenne Indian Reservations to determine the effectiveness of basal area cutting in second-growth ponderosa pine stands to reduce losses to the mountain pine beetle. This project will help develop management strategies for susceptible stands in eastern Montana. Four treatments, replicated twice on each Reservation, will be implemented: reduction of existing basal area through partial-cutting to 50, 65, and 80 square feet/acre and no-cutting (control). After treatment, each block will be monitored yearly for the first 5 years, then at 5-year intervals for 20 years.

INTRODUCTION

The mountain pine beetle (Dendroctonus ponderosae Hopk.) is a major bark beetle pest of ponderosa pine (Pinus ponderosa Laws.) throughout the tree's range. Primarily a threat to second-growth stands of mid-range diameters, the beetle readily kills large-diameter old-growth trees in some areas. Epidemics, particularly in second-growth ponderosa pine stands, have become widespread in many parts of the western United States. During the past decade, much information relating stand susceptibility to beetle attack with existing stand conditions has been obtained. Sartwell (1971), Sartwell and Stevens (1975), Griffin (1975), and Sartwell and Dolph (1976) have all shown a positive relationship between overstocked stand conditions and increased likelihood of beetle depredations. All have further postulated, or demonstrated, the effectiveness of thinning overstocked stands as a means of reducing losses to

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the beetle. Valuable data such as this is lacking for eastern Montana stands. Previously, we assumed that data collected in eastern Oregon, western Montana, or the Black Hills was applicable to eastern Montana. We have demonstrated that cutting strategies which change the dynamics of second-growth ponderosa pine stands can reduce beetle-caused mortality through the prevention of outbreak development or the reduction of an infestation already underway. The completion of this project will enable us to develop and validate these strategies for eastern Montana stands.

METHODS

In May 1984, candidate areas were examined and cutting blocks were selected in areas where beetles were either present or threatening, and where a sufficient component of susceptible trees remained. We selected an equal number of blocks on each Reservation based on stand susceptibility, infestation intensity and location, and where Reservation personnel indicated timber sales could most reasonably be administered (figure 1). Eight 10-acre blocks were to be located in each area: two blocks for each of the four proposed treatments--cuttings to residual basal areas of 50 square feet/acre, 65 square feet/acre, and 80 square feet/acre and no cutting at all (control).

In each area, stand conditions permitted the establishment of 10-chain square blocks (10 acres), with each of the eight blocks being nearly contiguous (figure 2). Blocks were established by compass and pacing, then boundaries were flagged and painted. Within each block, stand data were taken on six variable radius (BAF 20) plots spaced on an approximate 3-chain by 3-chain grid. The following data were recorded on each plot: diameter (at breast height) of each "in" tree, 5.0 inches d.b.h. and larger, to the nearest one-tenth inch; height and crown length of first three trees, to nearest foot; age, sapwood depth, and phloem thickness from two cores each of two dominant or co-dominant trees; and regeneration data for trees less than 5.0 inches d.b.h. on a fixed radius (one-three-hundredth-acre plot). In addition, each tree was given a "condition" code to indicate its relation to mountain pine beetle, or in some cases other bark beetles: unattacked, current-year attack, previous-year attack, older dead (mountain pine beetle-caused), pitchout (unsuccessful attack), current strip attack (attacked on one side of bole only), previous-year strip attack, secondary beetle attack (current year), secondary beetle attack (older dead), and mortality from unknown causes.

Forty-eight plots were established on each Reservation. Stand data were analyzed using the computer program INDIDS. Increment cores taken on each plot were placed in labeled plastic drinking straws and returned to the laboratory for later analysis.

Following data analysis, each block will be randomly assigned one of the four treatments. Once treatments have been assigned to the blocks, trees to be cut will be marked on a spacing basis determined by residual basal area desired and quadratic mean diameter of leave trees. A quadratic mean diameter of 10 inches d.b.h., for example, would result in the following spacings for the three levels of cutting desired:

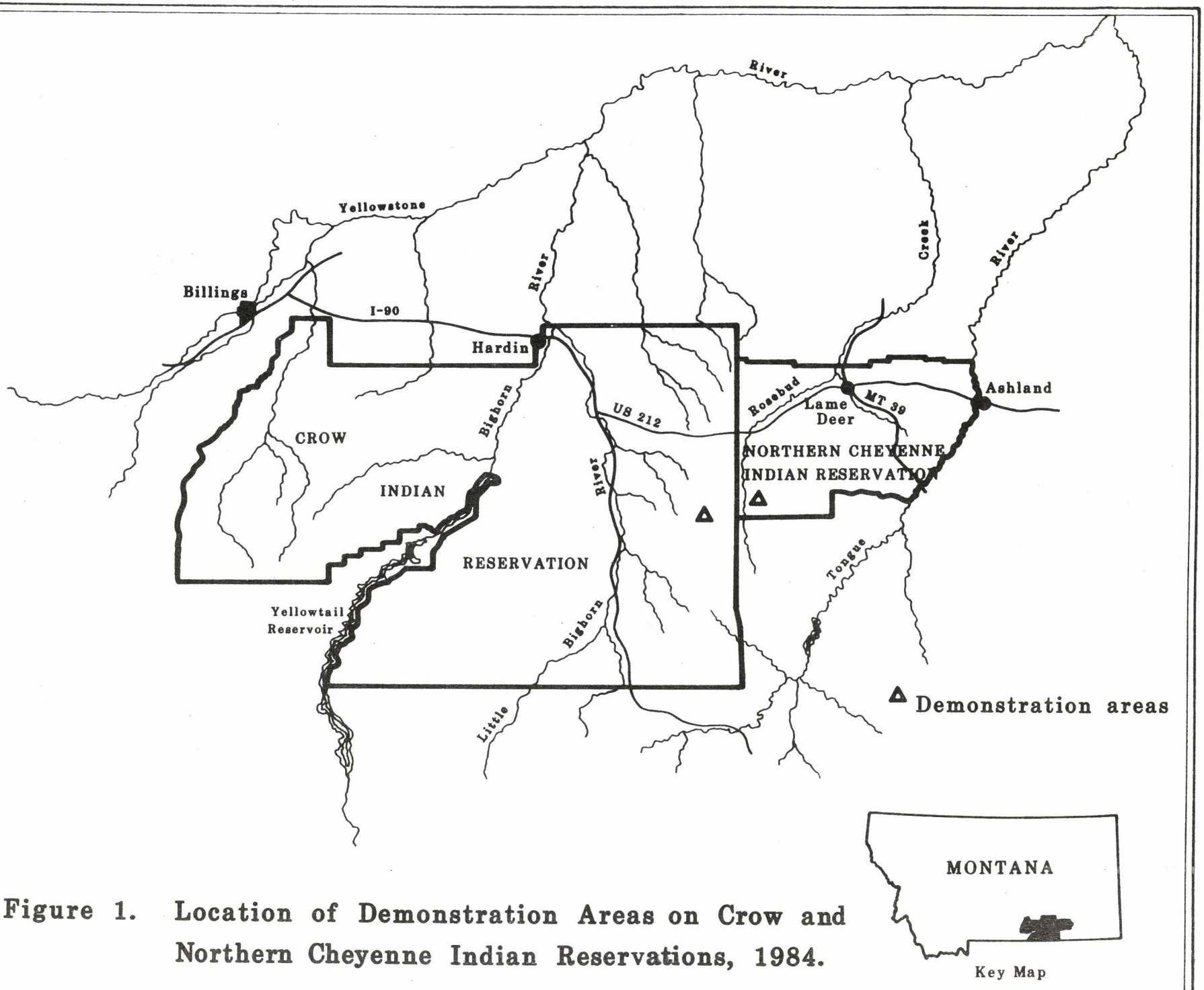
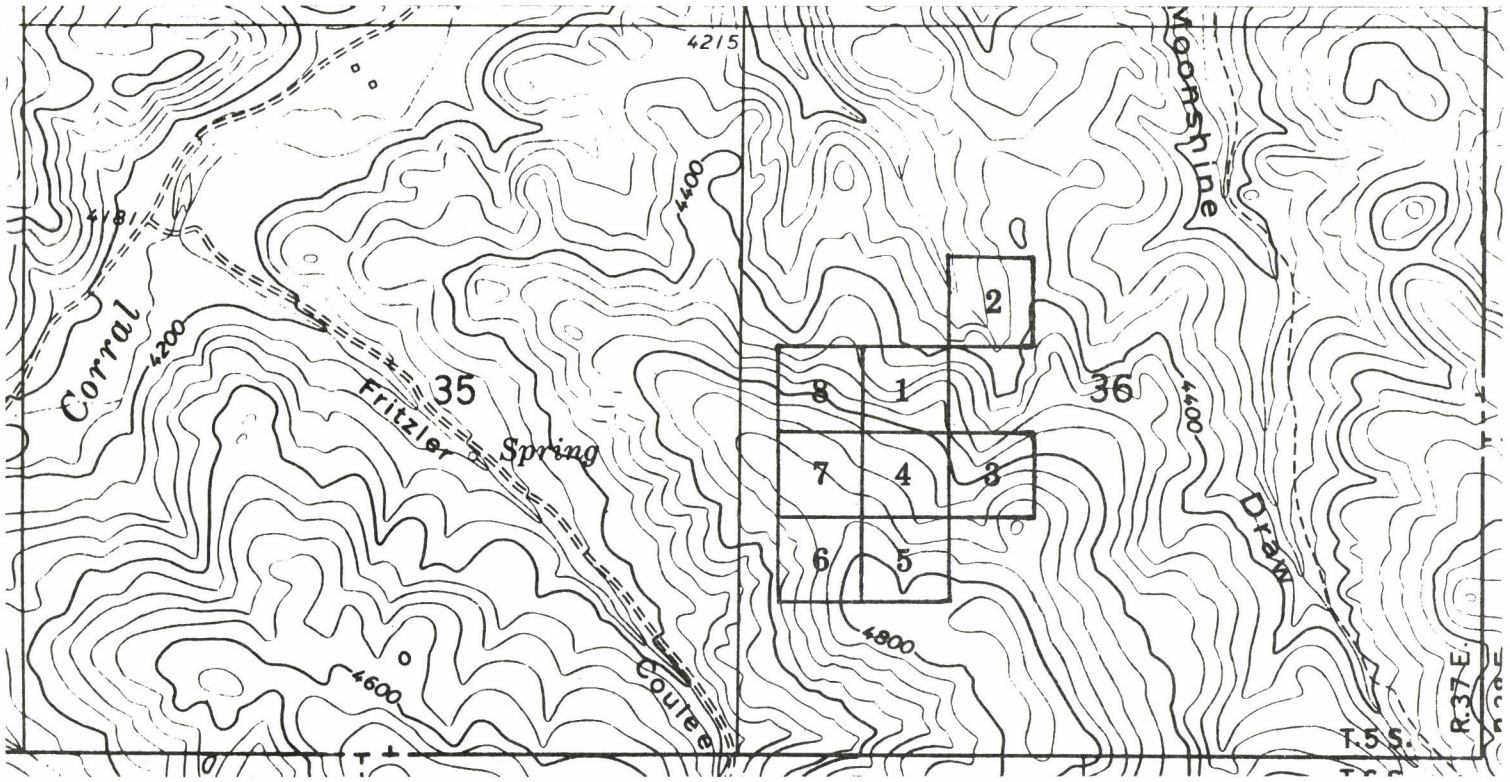
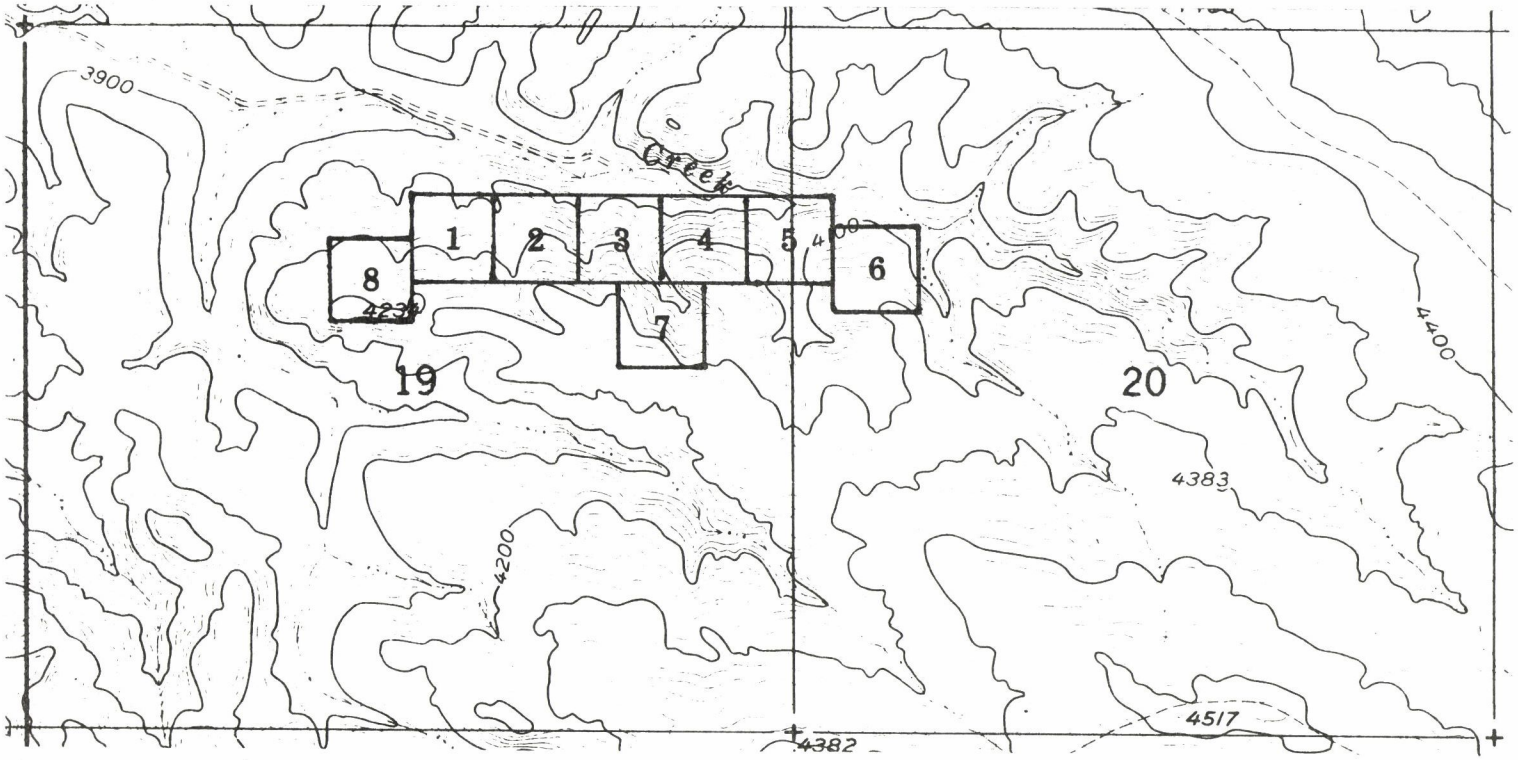


Figure 1. Location of Demonstration Areas on Crow and Northern Cheyenne Indian Reservations, 1984.



A. Crow Indian Reservation (T5S R37E S36)



B. Northern Cheyenne Indian Reservation (T5S R39E S19-20)

Figure 2. Demonstration Area Block Layout.

1. Residual basal area of 50 square feet/acre = approximately 92 trees/acre. Leave trees would be on approximately a 22- by 22-foot spacing.

2. Residual basal area of 65 square feet/acre = approximately 119 trees/acre. Leave trees would be on approximately a 19- by 19-foot spacing.

3. Residual basal area of 80 square feet/acre = approximately 147 trees/acre. Leave trees would be on approximately a 17- by 17-foot spacing.

When marking trees, dead and currently infested trees, plus those unsuccessfully attacked (pitchouts and strip attacks) should be marked for removal. Unmerchantable material, such as thick groups of small trees, malformed or diseased saplings and poles, etc. should be slashed at time of treatment. Maintaining the desired spacing is also critical as beetles will attack unthinned groups of two or more trees in otherwise thinned stands. Slash created that is more than 3 inches in diameter should be piled and burned or lopped and scattered in openings to prevent population buildups of pine engraver beetles (Ips spp.)

PREHARVEST DATA SUMMARY

Tables 1 and 2 show results of stand data collected on the 48 variable radius plots on the Crow and Northern Cheyenne IR's, respectively. Data from the increment cores have not yet been analyzed. In summary, some of the blocks on the Crow IR experienced a large number of beetle attacks in 1984. Surveys conducted following beetle flight showed five of the blocks with some level of current infestation. New attacks per acre ranged from a low of five in Block 8 to 62 in Block 5. Despite relatively high average new attacks per acre in some blocks, most blocks contain sufficient green trees to meet the requirements of the project. Those with the largest amount of dead and currently infested trees could still serve as control blocks. Remaining green trees per acre (more than 5.0 inches d.b.h.) range from 80 to 262. Basal areas (counting both live and dead trees) average from 107 square feet/acre to 291 square feet/acre. Provided the treatment blocks can be logged prior to beetle flight in 1985, this area will be more than adequate for the purposes of our demonstration.

The blocks on the Northern Cheyenne IR are not experiencing current beetle attacks. A few newly attacked trees were observed just outside one block, and large groups of infested trees occur directly east and north of the demonstration area. Green trees per acre, exceeding 5 inches d.b.h., vary from 192 to 453. Basal areas of the eight blocks range from 117 square feet/acre to 173 square feet/acre. Overall, average diameters are smaller than on the Crow IR; however, stand conditions and proximity to current infestations indicate susceptibility to the beetle is high. Implementing treatments prior to increased beetle populations will afford us the opportunity for more accurate interpretation of treatment effects.

Table 1.—Stand data summary, basal area cutting demonstration blocks, Crow IR, Montana [1]

Area		Unattacked trees	1984 attack	1983 attack	Older dead	Unsucc. attacks	1984 strip [2]	Older strip	1984 sec [3]	Older sec.	Unknown mort. [4]	Total	Total T/A [5]	BA [6]
Block 1	T/A [7]	124	22	–	4	–	–	2	–	2	–	154	226	136
	BF/A [8]	10,687	3,041	–	395	–	–	490	–	490	–	15,103		
Block 2	T/A	80	33	41	22	–	–	–	–	–	–	176	530	165
	BF/A	5,406	4,278	3,795	2,716	–	–	–	–	–	–	16,195		
Block 3	T/A	115	–	–	5	–	–	–	–	–	–	120	165	107
	BF/A	10,610	–	–	201	–	–	–	–	–	–	10,811		
Block 4	T/A	101	25	–	–	–	–	–	–	–	–	126	151	130
	BF/A	11,118	3,706		–	–	–	–	–	–	–	14,824		
Block 5	T/A	262	62	18	12	4	–	–	–	–	–	358	315	291
	BF/A	16,917	2,949	1,170	758	246	–	–	–	–	–	22,040		
Block 6	T/A	148	–	–	3	–	–	–	–	–	–	151	148	123
	BF/A	9,446	–	–	320	–	–	–	–	–	–	9,766		
Block 7	T/A	214	–	–	–	–	–	–	–	–	–	214	513	139
	BF/A	7,800	–	–	–	–	–	–	–	–	–	7,800		
Block 8	T/A	155	5	–	8	–	–	–	–	–	–	168	355	122
	BF/A	8,440	1,401	–	1,090	–	–	–	–	–	–	10,931		
Area Average	T/A	150	18	7	7	1	–	1	–	1	–	182	300	152
	BF/A	10,053	1,922	621	685	–	–	–	–	–	–	13,281		

Notes:

[1] Data based on 48 variable radius (BAF 20) plots.
[2] Strip attacks—attacked on one side of bole only.
[3] Secondary bark beetle attacks.
[4] Mortality due to undetermined causes.
[5] Total T/A = Total number live trees per acre.
[6] BA = Basal area (square feet per acre) live and dead trees.
[7] T/A = Trees per acre $\geq$5 inches d.b.h.
[8] BF/A = Board feet volume per acre.

Table 2.—Stand data summary, basal are cutting demonstration blocks, Northern Cheyenne Indian Reservation, 1984[1]

Area		Unattacked trees	1984 attack	1983 attack	Older dead	Unsucc. attacks	1984 strip[2]	Older strip	1984 sec[3]	Older sec.	Unknown mort.[4]	Total	Total T/A[5]	BA[6]
Block 1	T/A[7]	342	–	–	–	–	–	–	–	–	–	342	592	164
	BF/A[8]	5,408	–	–	–	–	–	–	–	–	–	5,408		
Block 2	T/A	453	–	–	–	–	–	–	–	–	–	453	902	173
	BF/A	4,865	–		–	–	–	–	–	–	–	4,865		
Block 3	T/A	335	–	–	8	–	–	–	–	–	–	343	734	172
	BF/A	7,164	–	–	488	–	–	–	–	–	–	7,652		
Block 4	T/A	192	–	–	–	–	–	–	–	–	–	192	892	117
	BF/A	5,812	–	–	–	–	–	–	–	–	–	5,812		
Block 5	T/A	217	–	–	4	–	–	–	–	–	–	221	667	154
	BF/A	8,865	–	–	261	–	–	–	–	–	–	9,126		
Block 6	T/A	196	–	–	–	–	–	–	–	–	–	196	1,046	160
	BF/A	9,006	–	–	–	–	–	–	–	–	–	9,006		
Block 7	T/A	252	–	–	–	–	–	–	–	–	–	252	852	131
	BF/A	4,493	–	–	–	–	–	–	–	–	–	4,493		
Block 8	T/A	216	–	–	–	–	–	–	–	–	–	216	716	127
	BF/A	5,617	–	–	–	–	–	–	–	–	–	5,617		
Area Average	T/A	275	–	–	2	–	–	–	–	–	–	277	800	150
	BF/A	6,404	–	–	94	–	–	–	–	–	–	6,498		

[1] Data based on 48 variable radius (BAF 20) plots.
[2] Strip attacks—attacked on one side of bole only.
[3] Secondary bark beetle attacks.
[4] Mortality due to undetermined causes.
[5] Total T/A = Total number live trees per acre.
[6] BA = Basal area (square feet/acre) live and dead trees.
[7] T/A = Trees per acre $\geq$5 inches d.b.h.
[8] BF/A = Board feet volume per acre.

DISCUSSION

Amman et al. (1984), in describing the project's objectives, stated the need for additional information relating beetle/stand dynamics and the beneficial effects of proposed treatments. In addition, we hoped to obtain data showing a relationship between root disease, particularly Armillaria mellea, and mountain pine beetle in second-growth ponderosa pine. Such relationships have been suggested from surveys conducted in the Front Range of Colorado (Fuller 1983) and Black Hills of South Dakota (Johnson 1983). On our initial visit to select project areas, a pathologist examined several stands, representing various stand conditions. No evidence of root disease or root disease organisms was found.

For the remainder of the project, though periodic checks for root disease symptoms will be made, no regular examinations will be conducted. If, during the course of the project, root disease symptoms appear in any of the treated stands, we will once again obtain the assistance of pathologists as described in the Work Plan.

Our primary objective will be the observation and documentation of effects of thinning overstocked second-growth ponderosa pine on present or developing mountain pine beetle populations. Comparing treatment effects with results on adjacent untreated stands (controls) will enable us to better predict an infestation's course on eastern Montana stands of certain characteristics--and make recommendations to help minimize those effects.

CONCLUSION

The timely implementation of proposed treatments will make project results more meaningful. Particularly on the Crow IR, where beetle populations are highest, it is imperative that treatments be implemented as soon as possible. On the Northern Cheyenne IR, where populations of beetles are not yet causing serious losses, it is still desirable to implement treatments as soon as practicable. The sooner we are able to administer prescribed cuts in these stands, the sooner we will be able to realize the project's objectives. With that data we will be better prepared to confidently make recommendations for the management of East-side, second-growth ponderosa pine stands susceptible to the mountain pine beetle.

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